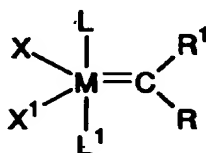


ABSTRACT

Ruthenium and osmium carbene compounds that are stable in the presence of a variety of functional groups and can be used to catalyze olefin metathesis reactions on unstrained cyclic and acyclic olefins are disclosed. Also disclosed are methods of making the carbene compounds. The carbene compounds are of the formula



where M is Os or Ru; R¹ is hydrogen; R is selected from the group consisting of hydrogen, substituted or unsubstituted alkyl, and substituted or unsubstituted aryl; X and X' are independently selected from any anionic ligand; and L and L' are independently selected from any neutral electron donor. The ruthenium and osmium carbene compounds of the present invention may be synthesized using diazo compounds, by neutral electron donor ligand exchange, by cross metathesis, using acetylene, using cumulated olefins, and in a one-pot method using diazo compounds and neutral electron donors. The ruthenium and osmium carbene compounds of the present invention may be used to catalyze olefin metathesis reactions including, but not limited to, ROMP, RCM, depolymerization of unsaturated polymers, synthesis of telechelic

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polymers, and olefin synthesis.